

# Climate Benchmark Missions: CLARREO

Bruce Wielicki and David Young, NASA Langley Research Center, Hampton, VA

WMO-BIPM workshop on “Measurement Challenges for Global Observing Systems for Climate Change Monitoring: Traceability, Stability, and Uncertainty

March 30 to April 2, 2010

Geneva, Switzerland

CLARREO (Climate Absolute Radiance and Refractivity Observatory) is one of the four Tier 1 missions recommended by the recent NRC decadal survey report on Earth Science and Applications from Space (NRC, 2007). The CLARREO mission addresses the need to rigorously observe climate change on decade time scales and to use decadal change observations as the most critical method to determine the accuracy of climate change projections such as those used in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR4). A rigorously known accuracy of both decadal change observations as well as climate projections is critical in order to enable sound policy decisions. The CLARREO mission accomplishes this critical objective through highly accurate and SI traceable decadal change observations sensitive to many of the key uncertainties in climate radiative forcings, responses, and feedbacks that in turn drive uncertainty in current climate model projections. The same uncertainties also lead to uncertainty in attribution of climate change to anthropogenic forcing.

The CLARREO breakthrough in decadal climate change observations is to achieve the required levels of accuracy and traceability to SI standards for a set of observations sensitive to a wide range of key decadal change variables. These accuracy levels are determined both by the projected decadal changes as well as by the background natural variability that such signals must be detected against. The accuracy for decadal change traceability to SI standards includes uncertainties of calibration, sampling, and analysis methods. Unlike most other missions, all of the CLARREO requirements are judged not by instantaneous accuracy, but instead by accuracy in large time/space scale average decadal changes.

Given the focus on decadal climate change, the NRC Decadal Survey concluded that the single most critical issue for decadal change observations was their lack of accuracy and low confidence in observing the small but critical climate change signals. CLARREO is the recommended attack on this challenge, and builds on the last decade of climate observation advances in the Earth Observing System as well as metrological advances at NIST (National Institute of Standards and Technology) and other standards laboratories.

The presentation will summarize the planned CLARREO observations, science priorities, requirements, and the dual strategy to provide climate change benchmarks directly from CLARREO observations, as well as to serve as a set of reference spectrometers in orbit capable of improving the calibration of other weather and climate sensors.